SIEMENS

ARCADIS Avantic

SP

Maintenance Instructions

System

Maintenance Instructions

The protocol SPR2-330.832.01.01.02 is required for these instructions

© Siemens AG 2005
The reproduction, transmission or use of this document or its contents is not permitted without express written authority. Offenders will be liable for damages. All rights, including rights created by patent grant or registration of a utility model or design, are reserved.

Print No.: SPR2-330.831.01.01.02
Replaces: n.a.

English
Doc. Gen. Date: 02.05

Document revision level

The document corresponds to the version/revision level effective at the time of system delivery. Revisions to hardcopy documentation are not automatically distributed.

Please contact your local Siemens office to order current revision levels.

Disclaimer

The installation and service of equipment described herein is to be performed by qualified personnel who are employed by Siemens or one of its affiliates or who are otherwise authorized by Siemens or one of its affiliates to provide such services.

Assemblers and other persons who are not employed by or otherwise directly affiliated with or authorized by Siemens or one of its affiliates are directed to contact one of the local offices of Siemens or one of its affiliates before attempting installation or service procedures.

Table of Contents

1 General information 4

Requirements . . . 4
Required documents . . . 5
Systems equipped with a laser light localizer . . . 5
Systems equipped with an I.I. laser light localizer . . . 5
Required tools, measurement and auxiliary devices . . . 6
Spare parts which may be needed . . . 7
Emphasized text . . . 8
Safety information and protective measures . . . 9
Abbreviation descriptions . . . 10
Maintenance interval . . . 11
System maintenance interval . . . 11
Technical Safety Checks (TSC) . . . 12

2 Inspection of exterior and surroundings 17

Inspection of exterior . . . 17
Inspection of surroundings . . . 18
Power outlets . . . 18

3 Safety inspection 19

Mechanical safety . . . 19
Electrical safety . . . 21

4 Maintenance, operating value/functional inspection 24

Maintenance . . . 24
Operating value inspection . . . 25
Functional inspection . . . 26

5 Final result/quality inspection and maintenance 28

Final work steps . . . 29

1 General information

1.1 Requirements

n.a.

1.2 Required documents

- Safety information according to ARTD, part 2
- Maintenance protocol SPR2-330.832.01..
- Main system adjustment instructions SPR2-330.842.01..
- Spare parts list
- Replacement of parts: SPR2-330.841.01.01.01
- Technical Safety Checks - Protocol* SP00-000.834.01...
- Image quality quick test SPR2-330.820.01..

1.2.1 Systems equipped with a laser light localizer

- Setting instructions SPR2-330.815.02..

1.2.2 Systems equipped with an I.I. laser light localizer

- Installation and setting instructions SPR2-330.814.02.01...
- Replacement instructions for the available TFT display
- 18” color display Eizo R11 TD00-000.841.15.01..
- 18” B/W display MVGD 13188 TD00-000.841.17.01..

1.3 Required tools, measurement and auxiliary devices

NOTE

All indicated tools, measurement and auxiliary devices, with the exception of those marked with a " * ", are described in the ARTD (Part 3).

• Standard tool kit*		
• Set of Allen keys*		
• Spring balance rated for up to 200 N	e.g.	44 15 113 RH090
• Equivalent leakage current tester	e.g. Safety Tester Unimet 1100	51 38 727Y0766
• Protective conductor meter	e.g. Safety Tester Unimet 1100	51 38 727Y0766
• Internal line resistance meter		84 28 104 Y4337
• DVM	e. g. Fluke 8060A	97 02 101 Y4290
• Luminous density measuring device	e.g. SPOTMETER for SMfit ACT 77 52 848	
• Densitometer	e.g.	97 02 416Y1996
• Dosimeter,	e.g. PTW Diados	97 17 612 Y0388
• Dynamic test kit		37 90 156 X1963
• Precision X-ray filter		99 00 598 XE999
• Set of resolution tests		28 71 820 RE999
• Set of radiation filters (10 x 0.3 mm)	e.g.	44 06 120 RV090
• Set of radiation filters	e.g.	97 98 596 G5321
• 25 mm AL measuring stand, type 26765 acc. to DIN 6868 Part 50*	e.g.	
or		
• 1.2 mm Cu (e.g. of a set of radiation filters 44 06 120) plus		
• 17 micrometer Cu strips		11 67 662
• Centering cross (only with Diamentor)	e.g.	96 60 051 RE999
• Sealing compound		34 43 009
• Special oil (Optimol Optipit)		55 07 525
• Special oil (Slic Pac PTFE)		55 07 517

1.4 Spare parts which may be needed

- Cable deflectors for swivel castor large/ARCADIS Avantic stand
- Cable deflectors for wheels small/ARCADIS Avantic stand
- Touch-up paint
- Spray paint

1.5 Emphasized text

⚠DANGER	**DANGER indicates when there is an immediate danger that l e a d s to death or serious physical injury.**
⚠WARNING	**WARNING indicates a risk of danger that m a y l e a d to death or serious physical injury.**
⚠ CAUTION	**CAUTION used with the safety alert symbol indicates a risk of danger that leads to slight or moderate physical injury and/ or damage to property.**
NOTICE	**NOTICE used without the safety alert symbol indicates a risk of danger that if disregarded leads or may lead to a potential situation which may result in an undesirable result or state other than death, physical injury or property damage.**

Fig. 1: Safety Notes

1.6 Safety information and protective measures

NOTICE

The following instructions must be observed!

- **When performing service work and tests adhere to:**
- **- The product-specific safety information in the documentation, safety information TD00-000.860.01.03.01,**
- **- As well as the general safety information contained in ARTD, part 2.**
- **Disconnect the power plug when working on the ARCADIS Avantic.**
- **General safety requirements should be observed when performing service while voltage is present.**
- **Observe ESD regulations!**
- **Before beginning maintenance, perform the protective conductor test according TD00-000.860.01.... The protective conductor resistance must not exceed 0.2 ohms.**
- **ARCADIS Avantic should be switched off before assemblies or boards are replaced.**
- **Perform the protective conductor test according to TD00-000.860.01... upon completion of the work and after all covers have been reattached. Document and evaluate the determined values. The protective conductor resistance must not exceed 0.2 ohms.**
- **After all work has been completed and all cover panels have been installed, perform the protective conductor test according to ARTD-002.731.17.**
- **The protective conductor resistance must not exceed 0.2 ohms.**
- **When performing work on the switch-on assembly (replacing the switch-on assembly or line voltage cable), the equivalent leakage current should be measured and documented.**
- **Checks and settings that need to be performed under X-ray radiation are identified by the radiation warning symbol . While performing adjustments labeled in this manner, radiation protective clothing must be worn.**

1.7 Abbreviation descriptions

Abbrev.	Description
SI	Safety Inspection
SIE	Electrical Safety
SIM	Mechanical Safety
PM	Preventive Maintenance
PMP	Periodic Preventive Maintenance
PMA	Preventive Maintenance Adjustments
PMF	Preventive Maintenance, Operating Value Check, Function Check
Q	Quality Check
QIQ	Image Quality
QSQ	System Quality Check
SW	Software Maintenance

The steps identified by these abbreviations are part of the maintenance protocol and should be checked off upon completion.

NOTE

The sequence for complete maintenance and inspection is described on the following pages.

Each work step must be performed on an annual basis, if not otherwise specified.

1.8 Maintenance interval

1.8.1 System maintenance interval

- **12 months**

1.8.1.1 UPS (Uninterrupted Power Supply)

- The lead-acid batteries of the UPS in the monitor cart are to be replaced every 36 months.

1.9 Technical Safety Checks (TSC)

Abbreviation: TSC = Technical Safety Checks

NOTE

Within the purview of DIN VDE 0751-1, the operator of medical engineering products has to perform technical safety checks at regular intervals.

The checks listed in these maintenance instructions contain all technical safety checks according to DIN VDE 0751-1 except for the check of the completeness, presence and legibility of the necessary operator documents.

A separate protocol with print number SP00.000.834.01... is available for each technical safety check.

Within the purview of DIN VDE 0751-1, we recommend documenting the maintenance results both in the maintenance protocol and in the TSC protocol. The protocols should be filled out completely and handed over to the client after maintenance is completed.

In the table below each technical safety check listed in the document SP00.000.834.01... is assigned to the corresponding maintenance work.

Technical safety checks, Test protocol check	**Maintenance instructions check/ Comments**
1 Identification data	Please fill in the fields.
2 General checks	n.a.
2.1 Visual inspection: Is there any damage affecting safety?	3.1 Mechanical safety, checks: SIM Covers SIM Cable deflectors SIM Foot brake SIM Brakes SIM Emergency stop switch SIM Monitors/displays
2.2 Are all cables and cable guides secure and without any visible damage?	3.2 Electrical safety, check: SIE cable and plug SIE Voltage discharge rubber

Technical safety checks, Test protocol check	Maintenance instructions check/ Comments
2.3 Are undamaged accessories being used?	3.1 Mechanical safety, checks: SIM I.I. laser light localizer mechanics SIM I.I. laser light localizer function SIM Laser light localizer mechanics SIM Laser light localizer function
2.4 Are all unit radiation protection devices present and undamaged? (No on-site radiation shield)	3.2 Electrical safety, checks: SIE Fluoroscopy timer SIE Audible warning signal SIE Compulsory radiation switch-off SIE Check of the radiation release switches SIE Dose rate SIE Radiation indicators SIE Iris collimator SIE Area dose product measuring unit
2.5 Are the required operator documents complete, present and legible?	Operating instructions must be available. Ask the customer for additional required operator documents and check them for completeness, availability, and legibility.
2.6 Are all warning labels in place and recognizable?	3.1 Mechanical safety, checks: SIM Warning signs SIM ID labels
2.7 Are the operating symbols, light indicators and button labels OK?	3.2 Electrical safety, check: SIE Operating function check
3. Electrical checks	n.a.
3.1 Measurement of protective conductor resistance	3.2 Electrical safety, check: SIE Protective conductor test 5.1 Final work steps, check: SIE Protective conductor test

Technical safety checks, Test protocol check	Maintenance instructions check/ Comments
3.2 Leakage current or equivalent leakage current measurement	n.a.
3.2.1 Leakage current measurement (for units with fixed power connection)	n.a.
3.2.2 Equivalent leakage current measurement (for units without fixed power connection)	3.2 Electrical safety, check: Equivalent leakage current 5.1 Final work steps, check: SIE Equivalent leakage current
3.3 Patient leakage current or equivalent patient leakage current measurement	n.a.
3.3.1 Patient leakage current measurement	n.a.
3.3.2 Equivalent patient leakage current measurement	n.a.
4. Mechanical checks	n.a.
4.1. Are all wall, ceiling and floor mountings secure and without damage?	3.1 Mechanical safety, checks: SIM Monitor(s)/displays
4.2 Are all mechanically moved system parts clean and running smoothly (lubricated, if required)?	3.1 Mechanical safety, checks: SIM Covers SIM C-arm SIM Lifting column
4.3 Are the wire cables, belts and spindles free of wear and tear?	3.1 Mechanical safety, checks: SIM Lifting column SIM 3D reconstruction
4.4 Mobile equipment: Are the wheels, rollers and brakes OK?	3.1 Mechanical safety, checks: SIM Foot brake SIM Brakes SIM Wheels and castors

Technical safety checks, Test protocol check	Maintenance instructions check/ Comments
4.5 Is there any unusual noise during operation (e.g. gearing)?	3.1. Mechanical safety, checks: SIM C-arm SIM Lifting column
5. Functional checks	n.a.
5.1. Are the emergency stop switches functional?	3.1. Mechanical safety, check: SIM Emergency stop switch 3.2 Electrical safety,
5.2 Are the warning devices functioning properly?	3.2 Electrical safety, checks: SIE Audible warning signal SIE Radiation indicators
5.3. Do all system movements stop properly in their end positions?	3.1 Mechanical safety, check: SIM Lifting column 3.2 Electrical safety,
5.4 Does the collision protection stop system movements properly?	Check the collision protection, provided that it is installed. Otherwise: n.a.
5.5 Are the safety distances (wall, floor, ceiling) met or ensured by other measures (e.g. light barriers)?	Check the measures provided that they are installed. Otherwise: n.a.
5.6 Are other safety cutoffs (e.g. safety step plate) functioning properly?	Check the measures provided that they are installed. Otherwise: n.a.
5.7 Are the table and system positions reproducible (e.g. zero positions, slice height, etc.)?	n.a.

Technical safety checks, Test protocol check	Maintenance instructions check/ Comments
6. Product-specific checks	3.2 Electrical safety, check: SIE Image quality quick test
7. Test result/evaluation:	Evaluate the long-term trends of the protective conductor resistance and the equivalent leakage current by comparing the current measuring values to those of preceding technical safety checks. A sudden or unexpected increase in the measured values may indicate a safety-related defect - even if the limit values are not exceeded. Follow the instructions for checks in the section on final work steps. Enter the results of the check. Have the operator, or a person authorized by the operator, sign the TSC protocol. Hand the TSC protocol over to the operator, or a person authorized by the operator.

2 Inspection of exterior and surroundings

2.1 Inspection of exterior

PMP Damage

Inspect the entire system for damage, such as damage to the housing or paint.

2.2 Inspection of surroundings

2.2.1 Power outlets

SIE Damage

SIE Line voltage

SIE Internal line resistance

- Inspect the power outlets used for system operation for damage.
- Measure the line voltage and compare it to the line voltage label on the monitor trolley.
- Measure the internal line resistance.

3 Safety inspection

3.1 Mechanical safety

SIM Covers

- Remove the covers from the ARCADIS Avantic stand and monitor trolley.
- Check the covers for mechanical damage.

SIM Cable deflectors

- Inspect the cable deflectors on the stand and on the monitor trolley and replace them if necessary.

SIM I.I. laser light localizer mechanics (if present)

- Inspect the I.I. laser light localizer for mechanical damage.

SIM I.I. laser light localizer function (if present)

- Perform maintenance on the I.I. laser light localizer according to Installation and setting instructions SPR2-330.814.02...

SIM Laser light localizer function generator (if present)

- Perform maintenance on the laser light localizer according to Start-up instructions SPR2-330.815.02.01..

SIM Foot brake

- Check the braking effect of the foot brakes of the ARCADIS Avantic stand and monitor trolley on a flat surface.

SIM Brakes

- Use the spring balance to check whether the orbital brake, angulation brake, swivel brake, horizontal lift brake, and vertical lift brake reach the defined braking values in the braked state (Replacement of Parts Instructions for ARCADIS Avantic).

SIM C-Arm

- Perform all C-arm movements, checking for slackness of the bearings and bearing noises.

SIM Wheels and castors

- Move ARCADIS Avantic straight on a flat surface.
- Evaluate the straight and quiet movement of the ARCADIS Avantic.
- Replace any defective wheels.

SIM Lift column

NOTE

There may not be any additional weight on the C-Arm, e.g. lead aprons or other covers, during these checks and adjustments.

- Switch the system on.
- Electrically move the lifting column over its entire lift range.
  - Listen for noises and check for play in the bearings.
  - The lifting column movement must switch off automatically when the end positions are reached.

- Operate the emergency stop button.
  - The motorized vertical lift is blocked.
- Unlock the emergency stop button by pressing it lightly and turning to the left.
- Switch off the system.
- Lubricate the lifting column.
  - Lubricate the bearing surfaces of the lifting column guide and the spindle.

SIM Emergency stop switch

- Press the emergency stop button.

  The lifting column may not be raised or lowered.
- Release the emergency stop button.

  The lifting column can be moved again.

SIM Warning signs

- Ensure that all required warning labels are attached and in good condition.
  - Replace any illegible labels or markings.

SIM ID labels

- Ensure that all required ID labels are attached and in good condition.
  - Replace any illegible labels or markings.

SIM TFT monitor(s)

- Check monitor(s) for damage.
- Check monitor(s) for proper attachment to the monitor trolley.
- Check additional monitors for damage and proper attachment to the wall support/monitor support system (if applicable).

3.2 Electrical safety

SIE **Cables and plugs**

- Check visible system cables and plugs for damage.

SIE **Fluoroscopy timer**

- Check: See "Compulsory radiation switch off" section.

SIE **Acoustic warning signal**

- Check: See "Compulsory radiation switch off" section.

SIE **Compulsory radiation switch off**

- Switch the system on.
- Test the functioning of the audible warning signal and compulsory radiation switch off (if required) according to the country-specific regulations. Also check functioning of the fluoroscopic timer in this process.

NOTE

The acoustic warning signal must sound every 4, 5.5, or 9.5 minutes of fluoroscopic time depending on the programming. It sounds again every 5 or 10 minutes. It is turned off by pressing the -0- button once. Pressing this button again resets the fluoroscopic timer to "0". Depending on the country-specific programming, either the required radiation shut off does not occur or it occurs every 5 or 10 minutes and then every 5 or 10 minutes after that.

SIE **Check the radiation release switch**

- Check the functioning of the hand and foot switches for radiation release.
- Check the cables of the radiation release switches for mechanical damage.
- Move the cables and inspect them for breakage.

SIE **Dose rate**

- Switch the system on.
- Check the dose rate (see Adjustment instructions, ARCADIS Avantic).

SIE **Radiation indicator**

- Activate fluoroscopy briefly.
  - ➪ The radiation indicator on the operating part of the ARCADIS Avantic stand and the radiation indicator on the monitor cart must light.
- Switch the system off.

SIE **Iris collimator**

- Check the iris collimator and correct it if necessary.
  - Select I.I. full format and activate fluoroscopy briefly.
  - The collimator blades must be clearly visible at the edges of the image.
  - Select a zoom format and release fluoroscopy briefly.
  - The collimator blades must be clearly visible at the edges of the image.

SIE **Voltage discharge rubber**

- Check the voltage discharge rubber on the ARCADIS Avantic stand and the wheels and castors of the monitor trolley for damage or contamination, and replace or clean them as necessary.

SIE Protective conductor test

- Test the protective conductor with the protective conductor meter according to ARTD-002.731.17.

NOTE

The equivalent leakage current is to be measured and documented using the equivalent leakage current tester according to ARTD-002.731.17 in the scope of validity of DIN VDE 0751. Refer to the "Final work steps" section.

SIE Equivalent leakage current

The equivalent leakage current is to be measured and documented using the equivalent leakage current tester according to ARTD-002.731.17 in the scope of validity of DIN VDE 0751.

NOTE

The instructions according to ARTD-002.731.17 are to be adhered to outside the scope of validity of DIN VDE 0751.

SIE Voltage discharge rubber

- Inspect the voltage discharge rubber on the SIREMOBIL stand and monitor trolley for damage or dirt. If necessary, clean or replace it.

SIE Protective conductor test

- Measure the protective conductor with the protective conductor meter according to **TD00-000.860.01...** .

NOTE

The protective conductor test is part of the safety inspection. However, it cannot be performed until all maintenance work has been completed. Refer to the "Final work steps" section.

SIE Equivalent leakage current

- Perform the equivalent leakage current test, with a closed system, according to TD00-000.860.01... . Document and evaluate the determined values. Document the measuring procedure.

  The equivalent leakage current must not exceed 2 mA.

NOTE

The equivalent leakage current test is part of the safety inspection. However, it is recommended to perform it only at the end of maintenance, with a closed system. Refer to the "Final work steps" section.

4 Maintenance, operating value/functional inspection

4.1 Maintenance

PMP Cleaning the system

- Clean the entire system:
  - Visible cables
  - Exterior surfaces
  - Contact surfaces of wheels
  - Interior space

PMP System ventilation

- Clean the ventilation slots of the ARCADIS Avantic stand and monitor trolley.

4.2 Operating value inspection

SIE **Dose rate**

- Switch the system on.
- Check the dose rate (see Adjustment instructions, ARCADIS Avantic).

PMF **Event log**

- Read out and evaluate the system event log.

4.3 Functional inspection

SIE TFT monitor

- Check the TFT monitor with the image quality assurance test.

SIE Area dose product measuring unit (if present)

- Check the area dose product measuring unit and the calibration. (See Main System Adjustment Instructions SPR2-330.842.01...).

PMF Laser camera connection (if present)

- Check the functioning of the laser camera connection.

PMF Check the operating function.

- Check all system operating functions.

PMF Monitor display of the iris collimator aperture

- Select I.I. full format.
- Close the iris collimator (X-iris) completely.
- Mark the diameter of the collimated iris collimator aperture on the monitor.

- Release fluoroscopy briefly. The actual diameter of the iris collimator is visible. The previously indicated monitor display must match the position and diameter of the actual iris collimator aperture.
- Open the iris collimator completely.
- Mark the diameter of the collimated iris collimator aperture on the monitor.

- Release fluoroscopy briefly. The actual diameter of the iris collimator is visible. The previously indicated monitor display must match the position and diameter of the actual iris collimator aperture.
- Select I.I. zoom format.
- Close the iris collimator (X-iris) completely.
- Mark the diameter of the collimated iris collimator aperture on the monitor.

- Release fluoroscopy briefly.

  The actual diameter of the iris collimator is visible. The previously indicated monitor display must match the position and diameter of the actual iris collimator aperture.
- Open the iris collimator completely.
- Mark the diameter of the collimated iris collimator aperture on the monitor.

- Release fluoroscopy briefly.

  The actual diameter of the iris collimator is visible. The previously indicated monitor display must match the position and diameter of the actual iris collimator aperture.

PMF PMF Monitor display of the slot diaphragm positions

- Select I.I. full format.
- Completely close the slot diaphragm and rotate the slot diaphragm from its basic position.
- Mark the distance and angle of rotation of the displayed slot diaphragm position on the monitor.

- Release fluoroscopy briefly.

  The actual position (distance of the plates and angle of rotation) of the slot diaphragm is visible. The previously displayed monitor display must match the position and angle of rotation of the actual slot diaphragm position.
- Open the slot diaphragm completely and rotate it again.
- Mark the distance and angle of rotation of the displayed slot diaphragm position on the monitor.

- Release fluoroscopy briefly.

  The actual position (distance of the plates and angle of rotation) of the slot diaphragm is visible. The previously displayed monitor display must match the position and angle of rotation of the actual slot diaphragm position.
- Select I.I. zoom format.
- Completely close the slot diaphragm and rotate the slot diaphragm from its basic position.
- Mark the distance and angle of rotation of the displayed slot diaphragm position on the monitor.

- Release fluoroscopy briefly.

  The actual position (distance of the plates and angle of rotation) of the slot diaphragm is visible.
- The previously displayed monitor display must match the position and angle of rotation of the actual slot diaphragm position.
- Open the slot diaphragm completely and rotate it again.
- Mark the distance and angle of rotation of the displayed slot diaphragm position on the monitor.

- Release fluoroscopy briefly.

  The actual position (distance of the plates and angle of rotation) of the slot diaphragm is visible. The previously displayed monitor display must match the position and angle of rotation of the actual slot diaphragm position.

NOTE

Perform this check with the lowest possible kV values so that the front edges of the slot diaphragm plate are effectively visualized.

PMF Battery replacement in the UPS

The lead-acid battery installed in the UPS must be replaced preventively every 36 months.

The replacement procedure is described in the supplied installation instructions from the manufacturer as well as in Replacement of Parts Instructions SPR2-330.841.01..

5 Final result/quality inspection and maintenance

SIE Image quality (IQ) quick test

- Perform the image quality test according to the image quality assurance test instructions

  for ARCADIS Avantic. Include additional monitors (if applicable).

PMP Maintenance

- Entire system: Touch up any paint damage as needed.

5.1 Final work steps

SIE Protective conductor test

SIE Protective conductor resistance

- Perform the protective conductor test with the system closed (ARTD- 002.731.17.).

  Document and evaluate the determined values.

  The protective conductor resistance must not exceed 0.2 ohms.

NOTE	**Evaluate the results by comparing the first measured value to the corresponding values documented during preceding maintenance procedures or safety checks.** **A sudden or unexpected increase in the measured values may indicate a defect in the protective conductor connections (protective conductor or contacts) - even if the limit value of 0.2 ohms is not exceeded.**

SIE Leakage current

- Measure the leakage current according to ARTD-002.731.17....

  Document and evaluate the determined values.

  The limit value of 2.5 mA may not be exceeded.

NOTE	**Evaluate the results by comparing the first measured value to the corresponding values documented during preceding maintenance procedures or safety checks.** **A sudden or unexpected increase in the measured values may indicate that an error occurred in the primary circuit of the power supply (damaged insulation, damage caused by water ingress or humidity, defective interference suppressor, etc.) - even if the limit value of 2.5 mA is not exceeded.**

30 Final result/quality inspection and maintenance